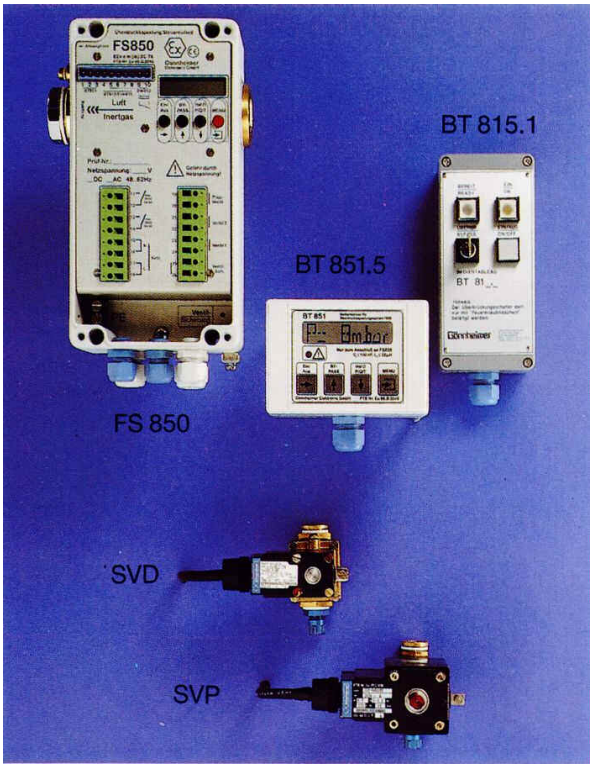
User's manual

Pressurized enclosure system

F 850S



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Gönnheimer Elektronic GmbH
http://www.goennheimer.de Email: info@goennheimer.de
Zertifiziertes Qualitäts-Managemantsystem nach DIN EN ISO 9001
Zert. Reg. Nr. Q1 0297038
Dr.-Julius-Leber-Straße 2
67433 Neustadt/Weinstraße
Postfach 10 05 07
67405 Neustadt
phone: +49 (6321) 49919- 0
fax: +49 (6321) 49919 - 41

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1 Safety Guidelines for explosion proofed devices

Application and Standards

This instruction manual applies to explosion protected control panels of type of protection types below. This apparatus is only to be used as defined and meets requirements of EN 60 079 particularly EN60 079-14 "electrical apparatus for potentiality explosive atmospheres". It can be used in hazardous locations which are hazardous due to gases and vapours according to the explosion group and temperature class as stipulated on the type label. When installing and operating the explosion protected distribution and control panels the respective nationally valid regulations and requirements are to be observed.

General Instructions

The control panel has to have a back-up fuse as stipulated. The mains connection must have a sufficient short circuit current to ensure safe breaking of the fuse. To achieve an impeccable and safety device o peration, please take care for adept transportation, storage and mounting, as well as accurate service and maintenance. Operation of this device should only be implemented by authorised persons and in strict a ccordance with local safety standards. The electrical data on the type label and if applicable, the "special conditions" of the test certificate *DMT 99 ATEX E 003* is to be observed.

For outdoor installation it is recommended to protect the explosion protected distribution and control panel against direct climatic influence, e.g. with a protective roof. The maximum ambient temperature is 40°C, if not stipulated otherwise.

Terminal compartment in Increased Safety

When closing, it is to be ensured that the gaskets of the terminal compartment remain effective, thus maintaining degree of protection IP 54 to DIN 40 050. Unused entries are to be closed off by impactproof stopping plugs, which are secured against self-loosening and turning.

Maintenance Work

The gaskets of Ex-e-enclosures are to be checked for damages and replaced, if required. Terminals, esp ecially in the Ex-echamber are to be tightened. Possible changes in colour point to increased temperature. Cable glands, stopping plugs and flanges are to be tested for tightness and secure fitting.

Intrinsically Safe Circuits

Erection instructions in the testing certificates of intrinsically safe apparatus are to be observed. The ele ctrical safety values stipulated on the type label must not be exceeded in the intrinsically safe circuit. When interconnecting intrinsically safe circuits it is to be tested, whether a voltage and/or current addition o ccurs. The intrinsic safety of interconnected circuits is to be ensured. (EN 60079-14, section 12)

Safety Measures: to read and to comply

Work on electrical installations and apparatus in operation is generally forbidden in hazardous locations, with the exception of intrinsically safe circuits. In special cases work can be done on non-intrinsically safe circuits, on the condition that during the duration of such work no explosive atmosphere exists. Only e xplosion protected certified measuring instruments may be used to ensure that the apparatus is voltage-free. Grounding and short circuiting may only be carried out, if there is no explosion hazard at the grounding or short circuit connection.

Warning! Extreme caution is advised when handling this device.
High electrical discharge is possible and can be fatal.

2 Introduction: Pressurized enclosure system F 850S

2.1 Explosion protection: pressurized enclosure

The use of pressurized enclosures allows the operation of 'non explosion protected' devices in hazardous areas inside zone 1 and zone 2. The protection type 'pressurisation' is based on the principle of maintaining a constant pressure using air or a protective gas to prevent an explosive mixture forming near the device inside the pressurized enclosure.

Before start-up, the pressurized enclosure must be purged with air or protective gas to remove any explosive mixture that may be inside the enclosure.

2.2 Pressurized enclosure system according EN50016, second release (5/1996)

According EN50016 second release from May 1996 are only those pressurized enclosure system allowed, which are safety examined according EN 954-1.

The FS 850 S reaches the category 3 according EN 954-1 [4] **(single fault evaluation).** That means that a single arbitrary fault can occur without losing the safety functionality.

2.3 Pressurized enclosure system F 850S

The pressurized enclosure system F 850S contains at least the control unit FS 850S and a solenoid valve. Each can be mounted in- or outside the enclosure. Furthermore several remote controls (operation panels) are available to improve ease of operation. It is also possible to connect intrinsically safe sensors to the control unit FS 850S.

The pressurized enclosure system F 850S operates in two different modes: Pressurization using leakage compensation and Pressurization using continuous flow of protective gas.

2.3.1 Mode pressurization using leakage compensation

After purging, the control unit FS 850S holds the pressure inside the enclosure at a minimum of 0,8 mbar. Two different solenoid vale techniques are available: digital working solenoid valve (DSV) technique or proportional working solenoid valve (PSV) technique.

a) Digital solenoid valve technique

While purging, the DSV is activated and a large amount of purge medium flows inside the enclosure through a nozzle with a large cross-section. After purging, the control unit turns off the DSV. The leakage compensation is made by a bypass choke, with a very small adjustable cross-section (diameter 0,3 ...1 mm), inside the valve. The protective medium that flows into the enclosure now is adequate to maintain a pressure of at least 0,8 mbar. The pressure is monitored by the control unit FS 850S. The maximum and minimum pressure of the enclosure is programmable.

For purging, a traditional and a new integrating method is available:

1. Using the traditional method the purge quantity is a product of a pre-set minimum of flow rate and time. The flow rate depends on the size of the internal nozzle (diameter 1 ...6 mm) of the valve and can be specified by matched charts. The common rule of purging must be considered: let in minus leakage loss is bigger than flow minimum. This purging method is called as **time based purging method**.
2. In contrast to the traditional one the **integrating purging method** measures the real volume flow through the enclosure outlet and adds it up to get the real purge volume. Also, the flow rate is monitored, depending on the size of the plate orifice of the control unit. If the flow rate sinks below its minimum, it will be ignored and it will not contribute to volume integration. Therefore we achieve a safe and economical purging method. See also Figure 1.

Pressure inside the enclosure will be observed by each purging method.

The digital solenoid valve technique has a considerable disadvantage: during purging process and normal operation, a constant rate of protective gas is needed. For safety reasons the rate must be larger than lea k-age rate of the enclosure. Wasting protective gas causes high costs in many applications.

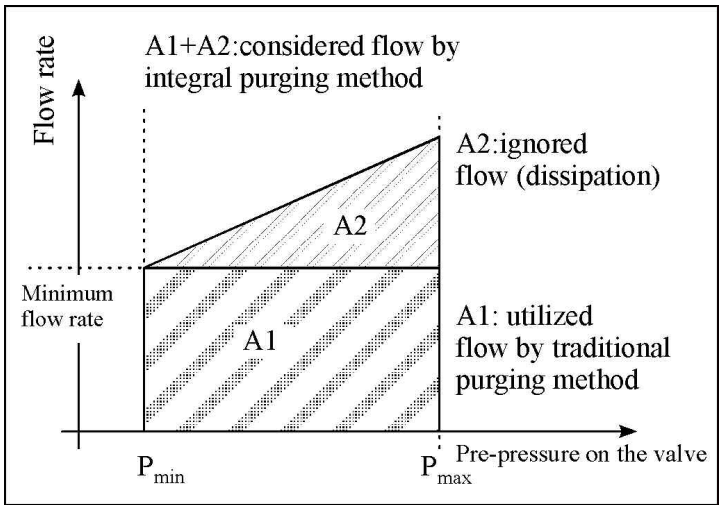


Figure 1: Consumption of protective gas

b) Proportional solenoid valve technique

Using proportional solenoid valve technique prevents unnecessary wasting protective gas. The internal proportional working sensory equipment and a proportional valve as actuator are combined to a **pressure feedback control system**.

Advantages of pressure feedback control are:

1. Considerable less consumption of protective gas - additional costs for proportional valve will be amortised soon
2. Increased service reliability achieved by constant pressure inside enclosure - increasing leakage caused by e.g. ageing of the enclosure will be balanced and sudden failure is pr evented
3. Almost no flow noise and only a small protective gas consumption using a solid enclosure

Another advantage using a proportional solenoid valve is; that pressure control is also used during purging. A set-point pressure will be achieved in the enclosure, while the flow volume, that leaves the enclosure, will be recorded and integrated through time, until the required purge volume is achieved. Advantages of this method are:

1. A definite pressure while purging - pressure sensitive parts of the enclosure, like membrane switch panels or windows, will not be overloaded.
2. Purge volume accuracy is achieved by integration of the purge medium flow volume at the outlet. Wasting purge medium is no more a topic of today.

2.3.2 Mode pressurization using Continuous flow

The control unit FS 850S incorporates the operation mode „continuous flow“. This operation mode is ne c-essary, for example if an analyser produces an explosive atmosphere inside the enclosure (containment system). The operation mode continuous flow fluhses the enclosure permanently. After the (pre-)purging procedure (purging process) a set-point flow rate is adjusted during normal operation. The monitored flow rate minimum is adjustable. The continuous flow operation mode can be realised using 2 digital solenoid valves as well as using one proportional sol enoid valve.

2.3.3 F 850S -Application using „Containment Systems“

„Containment Systems“ are defined as parts of a device within a pressurized enclosure, which could emit combustible gas (or occasionally an explosive environment: zone 1, explosive mixture) from within the enclosure.

In order to receive an EEx p-System including a „Containment System“, which is failsafe according EN 50016, with the attribute 'no emission', the following conditions must be met:

1. The flammable substance inside the containment system is in the gas or vapour phase when opera t-ing between the specified temperature limits
2. The minimum pressure specified for pressurized enclosure is at least 50 Pa higher than the max i-mum pressure specified for the containment system
3. An automatic safety device initiates, if the pressure difference falls below 50 Pa.

This automatic safety device can be activated by a difference pressure switch, looped into the external alarm loop (terminal 4/10 on FS 850S). If an alarm occurs on this loop, the control device FS 850S will turn off the ignition-capable device immediately. After alarm cancelling the control device FS 850S starts operation automatically with the purging procedure. The external alarm loop is made by a normal closed connection method.

2.4 Peripherals

2.4.1 Operating panels

For the control unit FS 850S several operating and visualising panels are available. These panels consist of the explosion protection class 'intrinsically safe' and are considerably advantageous, particularly when the control unit is mounted inside the enclosure.

1. Common operating panels: BT 854.1 and BT 855.1 with
   - On/Off-Switch
   - Key-operated switch for bypass
   - LED-indicator for READY and ON

   The connection to the control unit consists of 6 wires.

2. Intelligent operating panel type BT 851

   This operation panel indicates operation and malfunction reports as plain text. The 4 membrane switches of-fer total command of the control unit. Status, momentary pressure, flow rate as well as remaining purge time are always available.

   The connection to the control unit consists of only 3 wires.

2.4.2 Disconnector unit SR852

According to EN 50016 all non intrinsically safe connections of the ignition capable apparatus must be disconnect, if the protection gas pressure falls below the safety limit. In many applications more than the two connector terminals on the control unit FS 850S are needed. In these cases the disconnector unit SR 852, with 8 respectively 16 galvanically separated connectors, is considerable helpful.

3 Installation and connection

This Chapter contains important steps for mounting, connecting and starting.

3.1 Mounting

3.1.1 Control unit FS 850S

The control unit FS 850S can be placed inside a hazardous area. The location (inside or outside the encl o-sure) as well as the position is almost arbitrary. Only intake and outlet of the control unit should be lined up on a horizontal axis. See also Figure 11 in the Appendix.

The control unit has 4 holes on the rear plate for mounting, although fixing only with the screw connection of intake or outlet is sufficient.

NB **The solenoid valve(s) and the control unit (respectively pressure monitor) should be mounted on the enclosure as far away from each other as possible (E.g. space diagonal arrangement), to achieve a total purging.**

NB **Observe local safety guidelines and the regulative VDE DIN 57 165.**

3.1.2 Solenoid valves

The solenoid valves can be mounted inside or outside the enclosure. For mounting position see manufacturer's guide.

3.1.3 Operating panels BT 8xx.x

- Operating panel BT 851.0

  The Operating panel BT 851.0 is mounted, without rear plate, directly on the enclosure. For mounting and bushing of the wire, several holes must be made. For location and drill size see Figure 12: Dimensions and template BT 851in appendix.

- Operating panel BT 851.5

  The operating panel BT 851.5 has a housing with environment protection IP 65. It can be located anywhere in hazardous area zone 1. For location and drill size see Figure 12: Dimensions and template in appendix.

- Operating panel BT 814.x

  The operating manual BT 814.x consists only of 2 LEDs and an ON/OFF-switch, directly fixed on the enclosure. The BT 814.1 has an additional key-operated switch for bypass. For location and drill size see Figure 13: Dimensions BT 855, template BT 854 in appendix.

- Operating panel BT 815.x

  The operating panel BT 815.5 has a housing with environment protection IP 65. It can be located anywhere in hazardous area zone 1. For location and drill size see Figure 13: Dimensions BT 855, template BT 854 in appendix.

3.1.4 Disconnector unit SR 852

The disconnector unit SR 852 can be mounted and operated in hazardous area zone 1. It represents an Ex-e terminal box.

3.2 Connecting and starting

After mounting, connect the 'intrinsically safe' peripherals to terminal 1-10, and the power supply, valves and ignition-capable apparatus to increased safety terminals of the control unit.

Warning! **LINE VOLTAGE !**
Extreme caution is advised when handling this device. High electrical discharge is possible and can be fatal.

Tip **Please note the following Standard of Compliance:**
DMT 99 ATEX E 003 and the regulative VDE DIN 57 165.

Warning! **Do not exceed terminal safety limits of each terminal.**
See limits in technical details or declarations of conformity.

3.2.1 Terminal description FS 850S

Terminal		Description
FS 850S	BT 85x SR 852	
1	1	Terminals exclusively for connecting the operating panel BT 851
2	2	
3	3	
4	4	Terminals of operating panel BT 813, BT 814 and BT 815
5	5	
6	6	
7	7	
8	8	
9	9	
4		External alarm loop (intrinsically safe), opening circuit alarms EEx p-System and switching off ignition-capable device.
10		
11,12		Working current circuit 1
13,14		Working current circuit 2
15,16 -		Line voltage, acc. to realisation either neutral conductor at AC or minus pole at DC
17,18 +		Line voltage, acc. to realisation either outer conductor at AC or plus pole at DC
19,20 + ,-		Terminals for proportional solenoid valve
21,22 +,-		Terminals for additional digital solenoid valve 2
23,24 +,-		Terminals for digital solenoid valve 1
25,26		Terminals for solenoid valve fuse inside FS 850S

NB

If external operation panels BT 81x or additional pressure monitor are not used, it is possible to connect terminal 4 and 6 of the control unit FS 850S to a shorting bridge, to enable an automatic switch after purging process.
In this case, the On/Off-function of the far left button on the control unit FS 850S is non- operational.

3.2.2 Starting and parameter defaults

The following parameters are pre-set after connecting the FS850S to mains supply:

	Parameter	Display	Text	Comment
Structure	Mode: Leakage compensation Purging method: time based Type of valve: digital			
Codes	Main menu (M-Code) Bypass (By-Code) On/Off-Code (On/Off-C.)	0001 0002 0000		(Code 0000 turns code word test off; exception: M-code)
Pressure and flow	Purging time	00-10-00	10 [min]	time based purging method selected
	Purging volume	500.0	500 [l]	integ. purging method selected
	Min. flow while purging	1.0	1 [l/s]	time based purging meth. selected
	Min. flow while operating	0.5	0,5 [l/s]	operation mode continuous flow
	Flow set-point	2.0	2,0 [l/s]	selected
	Min. pressure inside enclosure	0.8	0,8 [mbar]	
	Max. press. inside enclosure	15.0	15 [mbar]	
	Set-point press. while purging	10.0	10 [mbar]	proportional solenoid valve selected
	Set-point press. while operating	2.0	2 [mbar]	

Reset **Press red bottom (*ENTER-Button)** while switching on the control unit FS 850S to reset all parameters to the values in table above.**

*: used only on control unit FS 850S.

3.2.3 Operation hints: purging process

The control unit FS 850S starts the purging process immediately after start up, providing the programmed minimal pressure (minimum 0.8 mbar) is present. Parallel to pressure monitoring, the flow rate will be watched, to get a safe purging process.

If the purging flow rate passes its minimum (e.g. temporary shut at the outlet), then the purging process will be interrupted and the control unit continues purging, after the disturbance is gone. But if purging pressure exeeds the min or max limits then the purging process will be terminated and the control unit will start a new purging process automatically after achieving purging co ndition.

The table below shows the minimum flow rate in accordance of the used plate orifice.

Plate orifice in control unit	Minimum flow rate
∅ = 4 mm	0,07 liter /sec.
∅ = 6 mm	0,15 liter/sec.
∅ = 10 mm	0,35 liter/sec.
∅ = 14 mm	0,85 liter/sec.
∅ = 18 mm	1,25 liter/sec.

4 Operation manual

The user has total control of the purging system F 850S by the use of 4 keys on the control unit FS 850S respectively by using the external operating panel BT 851. Operation on control unit FS 850S panel BT 851 is equal. Using the other operating panels only a restricted operation is possible.

4.1 Display

The built-in display indicates operation modes, present pressure or flow rate data, as well as malfunction.

4.2 Keyboard

The four multi-functional keys have different meanings and functions depend on the present operation mode.

Key	Operation mode	Function
Ein/Aus *„Shift right“-button*	normal operation	Toggles the ignition-capable device on and off, if purging sy s-tem state is ready
	running menu	Shift cursor one position right.
BYPASS *„Up“-button*	normal operation	Activates Bypass; i.e. enable toggle ignition-capable device on or off independently of the purging status.
	running menu	Get menu next item
INFO /P/Q/T *„Down“-button*	normal operation	Changes indication of the display: present pressure, flow rate, remaining purge time respectively purge volume and present state of the purging system
	running menu	Get previous menu item
MENU *„Enter“-button*	normal operation	Executes main menu
	running menu	Initiates and confirms parameter input

4.3 How to enter and leave the bypass mode

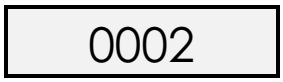
Warning! **Utilise bypass only, if it is sure that no explosive atmosphere is inside the cabinet!**

Warning! **The bypass mode is denied, if it is possible that a explosive atmosphere can arise inside the EEx p- housing !**

The origin state is normal operation, the EEx p housing can be purged, unpurged or while purging. The steps shown below are according to the control device FS850 not to the operation panel BI851.x.

If you have a operation panel BT81x.1 use the key switch instead.

The bypass code is needed



The ex works Bypass code is ‘0002’.

Enter is right code using the arrow keys and confirm with the *ENTER*- key.

The bypass mode is now active.

Or

If the control unit is set to “automatic on” the display shows “bypass” and “On” alte r-nately and the relay contacts (Ter. 11,12 and 13,14) are closed.

Now you can toggle the relay contacts by pressing the “right-“ button. Remark: if the E/A- code is unequal to zero, you must enter them each time you want to change the relay contacts state.

NB Leave the bypass mode in the same way to enter.

4.4 Indications during normal operation

The info-indication shows the present state of the purging system. In addition to this indication, it is poss i-ble to select current pressure-, flow rate-, or remaining purge time- indication. See below:

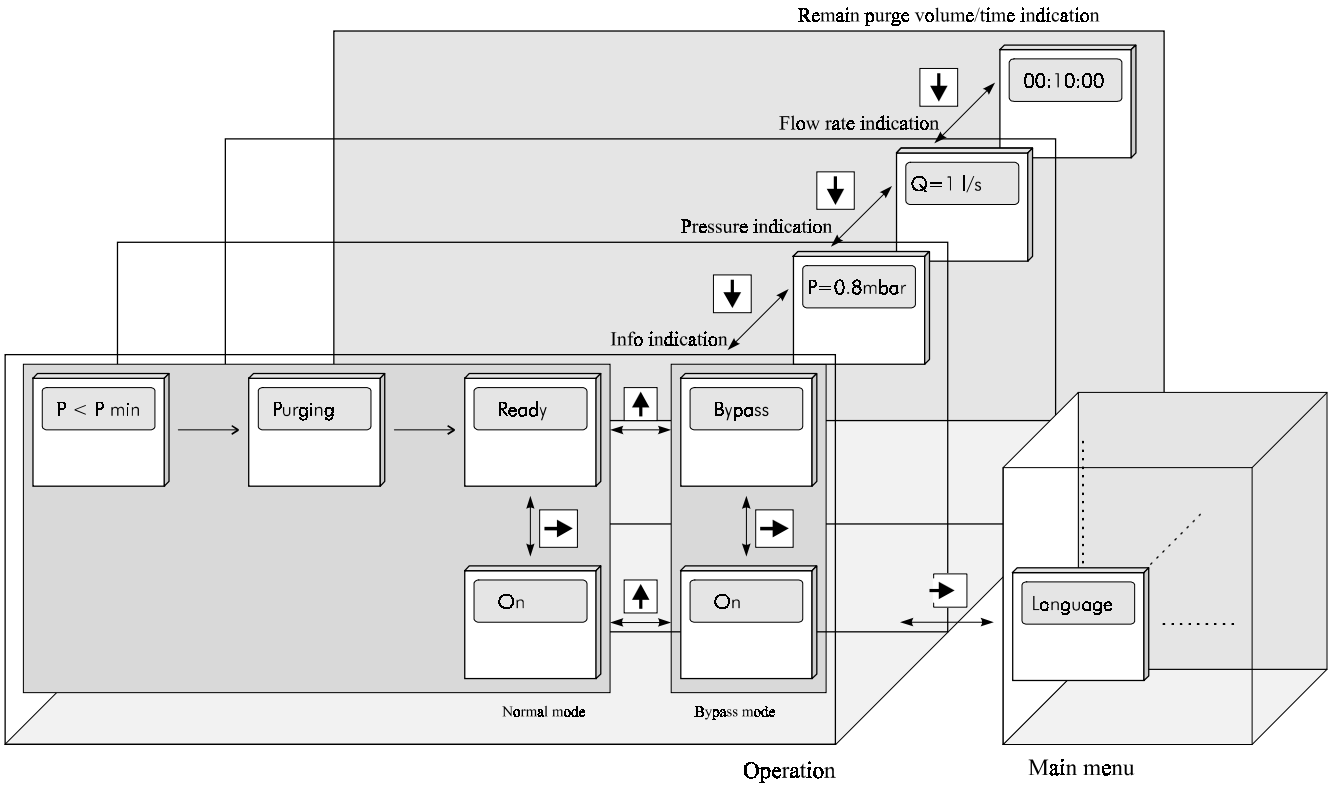


Figure 2 Flow chart: state of purging system and corresponding display

4.5 Configuration

You must configure and enter the parameters of the control unit FS850S to achieve a desired mode of o p-eration. All parameters of the control unit are structured in form of a menu. See also the flow charts in chapter 5.

4.5.1 The menu format

Main menu The main menu is sub-divided into 4 separate categories:

- Language
- Structure
- Parameters
- Codes

Language These are the 5 languages available:

- German
- English
- French
- Dutch
- Spanish

Structure Selecting a purging system structure with the following alternatives:

- Operation mode leakage compensation or continuous flow
- Using digital or proportional solenoid valves
- Integration or time based purging method
- Using an additional pressure monitor
- Using the disconnector unit SR852

Parameters This category contains the necessary parameters depending on the structure d efined above. Examples for parameters are:

- Purging time
- Minimum flow while purging process
- Minimum pressure
- Maximum pressure

Codes The control unit has 3 different code words:

- M-Code: to enter main menu
- By-Code: to activate Bypass
- E/A-Code: to switch ignition-capable apparatus on or off

NB **The FS850S does not working during running main menu. - That means the solenoid valves and the ignition capable device inside the cabinet are switched off.**

4.5.2 Explaining the main menu

The display of the control unit has only 8 digits. For this purpose the names of the structures and param eters are often abbreviations.

In the following table below are some explanations of the menu items. The table as a reference guide for programming the desired system structure and to set the appropriate parameters correctly. The menu items are roughly sorted by class.

Please note that the viewable conditions of parameters are not included. The category 'Language' is also excluded, because of it's simplicity.

See also the corresponding flow charts in chapter 5.

Cassification			
1.Level	2.Level	3.Level	Description, Explanation
Structure	Valves	P-Valve	Selecting 'valves' on level 2 means that a ***proportional solenoid valve*** or a
		D-Valve	***digital solenoid valve*** is available on level 3
	Integra.	Integ. Y	***Integration purging method, Yes*** Configures integration purging method.
		Integ. N.	***Integration Purging method, No*** Selects time based purging method.
	Cont.Flow	C. Flow Y.	***Continuous Flow, Yes*** Activates the operation mode 'continuous flow'.
		C. Flow N.	***Continuous Flow, No*** Activates the operation mode 'leakage compensation'.
Param.	Pur. Time	.....	***Purge time -*** Enter a fixed purge time in h/min/sec. The purge time only appears, if the time based purging method is chosen.
	Pur. Vol.	.....	***Purge volume -*** The purge volume only appears, if integration purging method is chosen.
	Min.Fl. P.	.....	***Minimum flow rate*** *during* ***purging process***

	Min.Fl .O.	.....	***Minimum flow rate** during **operating***
	Rated Fl.	.....	***Flow rate set-point*** - In operation mode 'continuous flow' this flow rate will be regulated, while normal operation.
	Min.Pres.	.....	***Minimum pressure inside enclosure*** Only values above ≥ 0.8 mbar can be entered. (Additional safety regulativ to EN 50016)
	Max.Pres.	.....	***Maximum pressure inside enclosure*** Maximum pressure ≤ 18 mbar
	R. Pre. Pu.	.....	***Pressure set-point*** during ***purging***, This pressure value will be regulated during purging process.
	Rated Pr.	.....	***Pressure set-point*** during ***normal operation,*** This pressure value will be regulated during normal operation.
Codes	M-Code	.....	***Menu code -*** Code word to enter main menu out of operation mode. The M-code could not switched of by setting M-Code =„0000" .
	By-Code	.....	***Bypass code -*** Code word to activate the bypass. The bypass code word can be switched off by setting „0000". The bypass code „9999" blocks the bypass function. In that case a bypass can only be activated by key-operated switch on BT 81x.
	On/Off-C.	.....	***On/ Off code***, enables switching on or off the ignition-capable device. The On/Off code word can be switched off with „0000".

4.5.3 Configuration Example

Example-
EEx p-System

⇒ Enclosure volume: 500 l

⇒ Language : English

⇒ Structure :

- Operation mode: leakage compensation
- Integration purging method
- Proportional solenoid valve

⇒ Parameters

- Purging volume: 2500 l
- Minimum pressure of enclosure: 0.8 mbar
- Maximum pressure of enclosure: 12 mbar
- Set-point pressure purging process: 10 mbar
- Set-point pressure normal operation: 1.5 mbar

⇒ Codes

- M-Code: 0001
- By-Code: 0002
- E/A-Code: 0000 (switch off)

Procedure:

Press the *Enter-button* to start main menu. The control unit calls for the M-code to be entered.

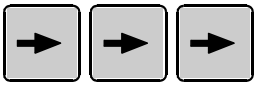
M-Code

The ex works M-code is ‘0001’.

Press the *Enter-button* to insert M-Code.

_000

Display shows ‘0000’, the far left digit is flashing.



Press the key sequence on the left side

to enter code ‘0001’,

0001

(the present M-Code).

Confirm the code input pressing *Enter-button*

Sprache

The main menu is now active. The first sub menu ‘Language’ appears on the display. The default language of ex works is German.

To alter the language, press *Enter*.

Deutsch

On the left appears the word ‘Deutsch’

Press the *Up-button* to change the language.

English

The language ‘English’ is now selected.

Press the *Enter-key* to confirm the change.

Structure

Category ‘Structure’ appears.

Press the *Enter-key* to configure the EEx p-system structure.

Valves

The first item of the structure menu is the choice of the sol enoid valve.

Press the *Enter-key* to change state.

D-Valve

The present state is digital solenoid valve.

Change the state by pressing *Up-key* -

P-Valve

The new state is now ’Proportional solenoid valve’.

Confirm the change by pressing *Enter-key.*

Cont.Flow

This item is the operational mode 'continuos flow' or 'leakage compensation'. The ex works state is already 'leakage compensation' therefore:

skip this item by pressing the *Up- key.*

Param.

The structure menu is now finished. The main menu continues automatically with the pre-selected parameters.

Start the parameter category by pressing the *Enter- key*.

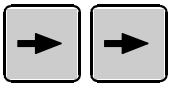
Pur. Vol.

The first menu item ‘Purging volume’ appears.

Press the *Enter- key* to enter the desired volume ‘2500 l’.

_00500 l

Expecting a pre-set purging volume of 500 l, the input sequence is as follows:



00_500 l

002500 l

Confirm the input by pressing the *Enter- key.*

Min.Pres

The desired minimum pressure of 0.8 mbar is already adjusted ex works. Continue skipping this menu item by pressing the *Up- key* or view by pressing the *Enter- key.*

Max.Pres.

Now enter the desired value of the maximum pressure. Modify the present parameter as shown above.

012.0mbar

The desired maximum pressure is 12.0 mbar.

R. Pre. Pu

The desired set-point pressure during the purging process of 10.0 mbar is already adjusted ex works. Continue passing this menu item by pressing the *up- key.*

Rated Pre.

The desired set-point pressure during normal operation must be adjusted. Modify the present parameter to 1.5 mbar as shown above.

Codes

The parameter category is now finished. The main menu continuous automatically with the sub menu codes.

M-Code

Modify M-Code to ‘0001’ as shown above. Please note: the **M-Code cannot be set to ‘0000’.**

By-Code

Modify By-Code to ‘0002’ as shown above.

On/Off-C.

Set the On/Off-Code to switch the ignition-capable apparatus on or off to ‘0000’. This code word is from now on disabled.

End

The main menu settings are now complete.

After pressing the *Enter- key,* the purging system is in operation state.

4.6 Alarm and malfunction indications

Alarm	*Cause*	*Remedy*
Ext.Alar	The external alarm occurred, i.e. the external alarm loop is broken. If the external alarm loop is not used, disable the external alarm loop by a shorting bridge.	Fix shorting bridge to terminal 4 and 10 of the control unit FS 850S.

Error message	*Cause*	*Remedy*
Error E.	EEPROM Read Error Stored configuration data is incomplete or corrupt.	Turn FS 850S off. Turn FS 850S on. If the error message occurs again, then return the control unit FS 850S to Gönnheimer Elektronic.
Error P.	Pressure sensor Error The integrated pressure sensors do not work properly	
Error Q.	flow sensor Error The integrated flow sensors do not work properly	
Error C.	Hardware - fault	

5 Flow charts

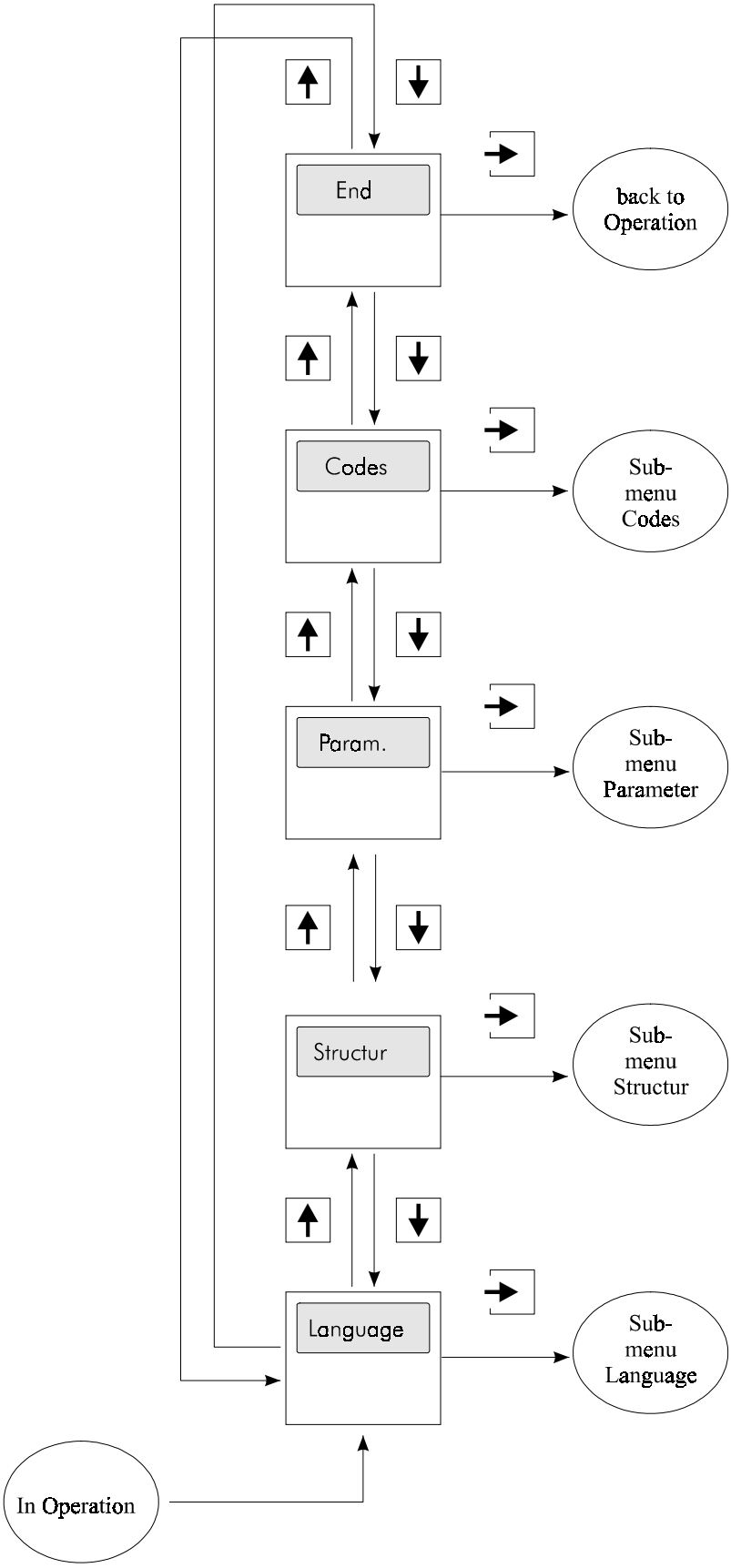


Figure 3 Flow chart main menu

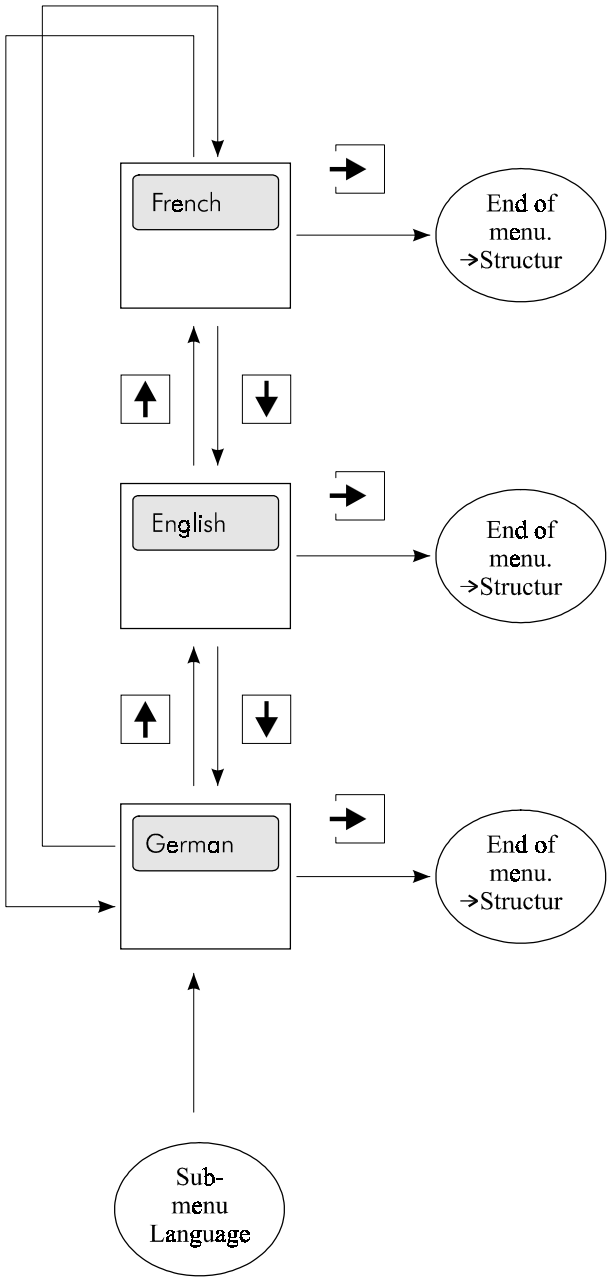


Figure 4 Flow chart language menu

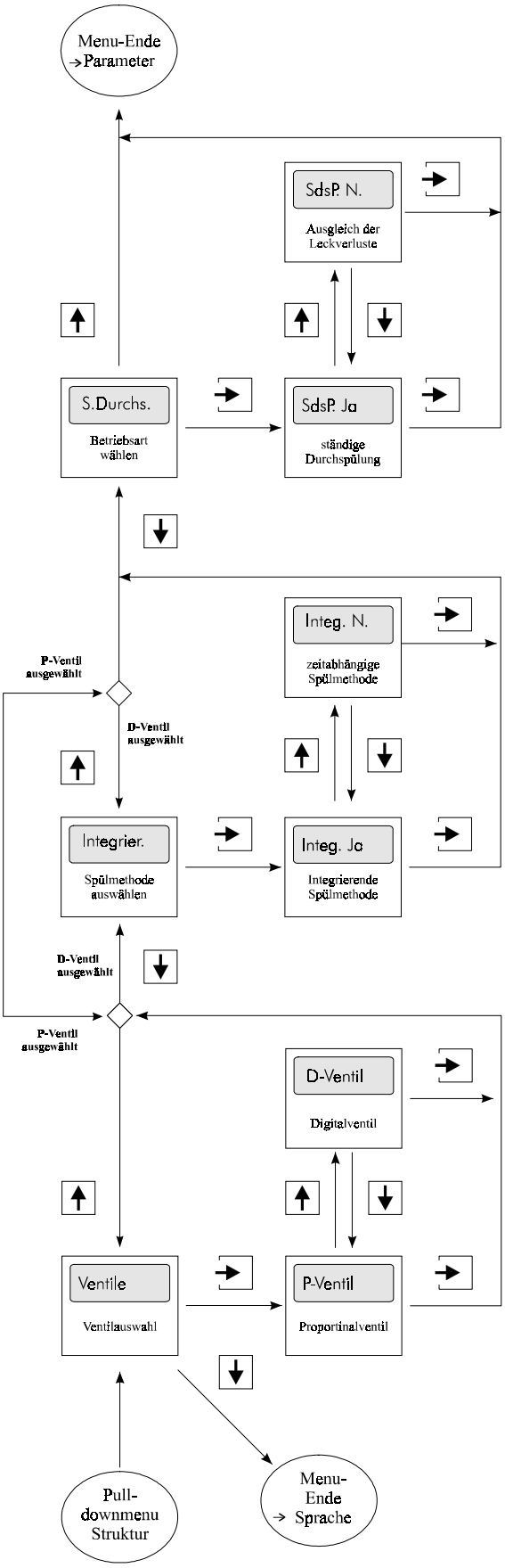


Figure 5 Flow chart structure category

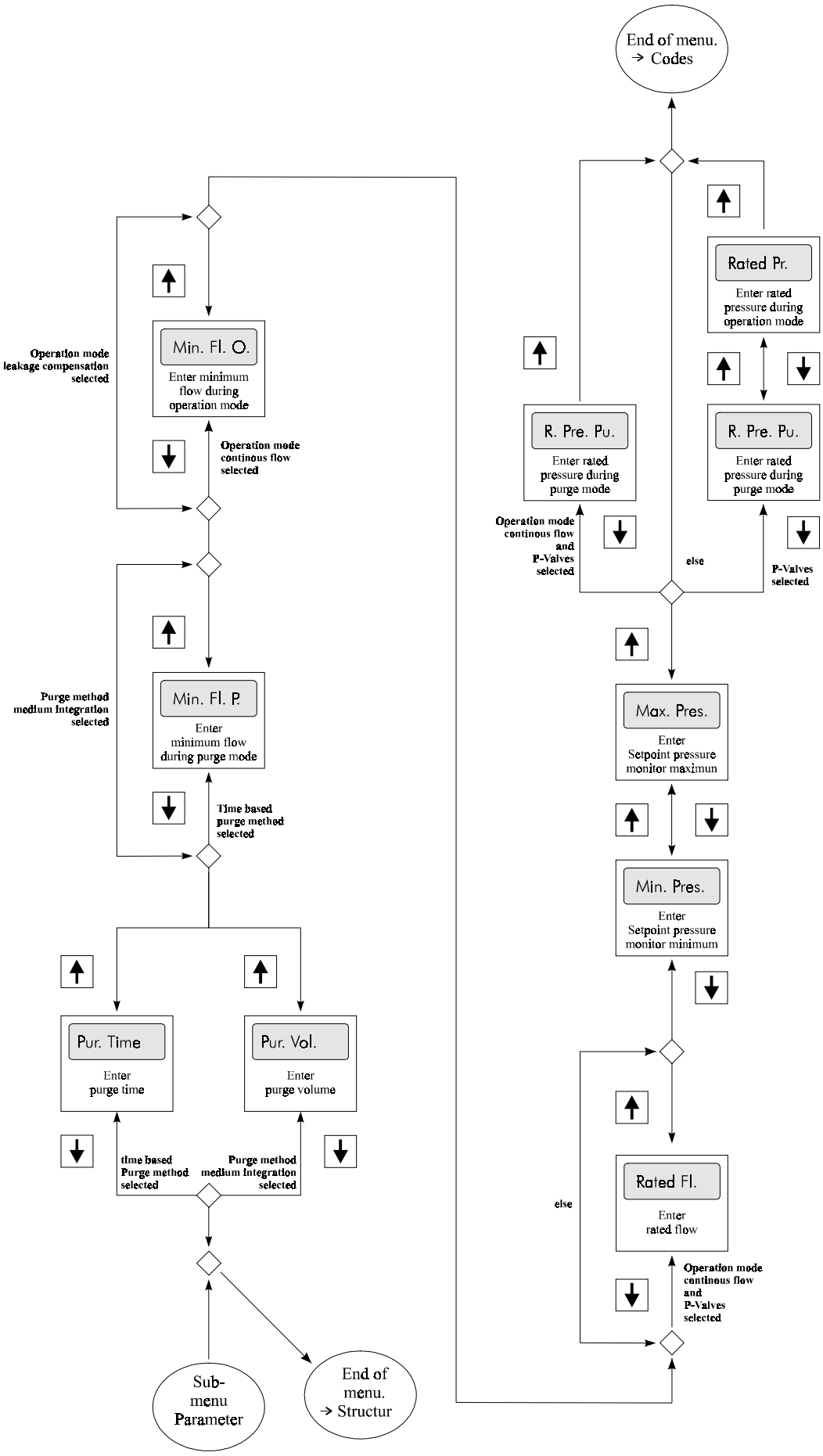


Figure 6 Flow chart parameter category

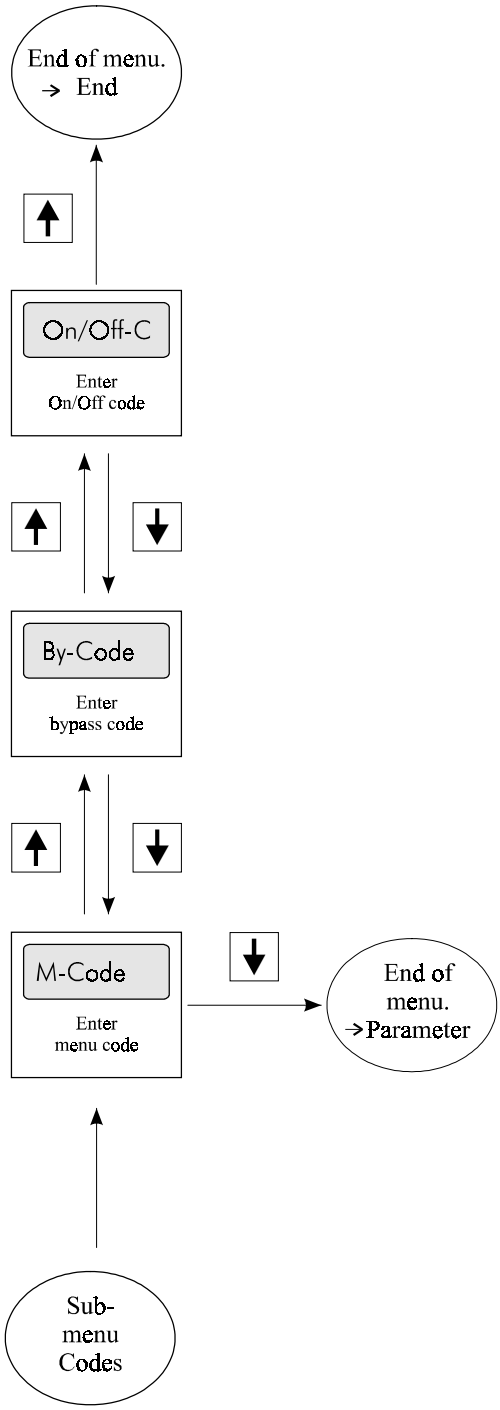


Figure 7 Flow chart code category

6 Appendix

6.1 Tables

plate orifice size

Plate orifice [mm]	Flow rate is about [m^3/h]
4	0,5 ... 1,1
6	1,1 ... 2,7
10	2,5 ... 6,5
14	6 ... 11
18	9 ... 15

The right diameter of the plate orifice depends upon the desired volume flow rate on the enclosure outlet and the built in nozzle of the solenoid valve. Flow rates into enclosure depend upon primary pressure and nozzle diameter.

Pressure [bar]	Flow rate [l/s] ρ_{Air} = 1,293 kg/m^3 Nozzle diameter [mm]									
[10^5Pa]	0,3	0,5	0,7	1	1,5	2	3	4	5	6
1,5	0,0275	0,076	0,149	0,304	0,693	1,208	2,676	4,653	7,06	9,796
2	0,0338	0,094	0,184	0,374	0,838	1,48	3,27	5,651	8,511	11,098
2,5	0,0391	0,109	0,213	0,433	0,968	1,708	3,759	6,471	9,685	13,199
3	0,0438	0,0121	0,238	0,484	1,063	1,908	4,186	7,177	10,682	14,445
3,5	0,048	0,133	0,261	0,53	1,195	2,087	4,569	7,804	11,554	15,511
4	0,0518	0,144	0,282	0,573	1,28	2,252	4,917	8,37	12,33	16,441
4,5	0,0554	0,154	0,301	0,612	1,367	2,404	5,239	8,883	13,032	17,263

6.2 Technical Details

		Control unit FS 850S
General	Mounting	inside hazardous area
	Ex-protection class	E Ex e m [ib] IIC T6
	Environment protection	IP 65 (Remark: without outlet drill)
Housing	Dimensions	H x W x D: 220 mm x 120 mm x 90 mm
	Material	Aluminium, lacquered / Ral 7035
Electrical specifications	Power consumption	About 2.5 VA (without peripherals)
	Main voltage	24VDC, 24VAC, 110VAC, 120VAC, 220VAC, 230VAC 48 ...62 Hz
	Working circuits Terminal 11, 12, 13, 14	AC: U ≤ 250VAC, I ≤ 5A at cos φ > 0,7 DC: U ≤ 30 VDC, I ≤ 5 A, P ≤ 150 W
	Control circuits Terminal 1..10	Ex protection class: intrinsically safe E Ex ib IIC see declaration of conformity for further details DMT 99 ATEX E 003
Pneumatic	Pressure range	0 ... 18 mbar
	Flow rate range	0,5.. 15 m^3/h, dependent upon plate orifice size
Mounting	Position	position independent, only intake and outlet of the control unit should be lined up on a horizontal axis.
	Environment temperature	-10°C ...+50°C at T6 -10°C ...+60°C at T4
EEx p Configuration	Parameter input	LC-Display, menu guided Different languages : German, English, French, Dutch, Spanish
	Storage	by EEPROM double saved with CRC

6.3 Block diagrams

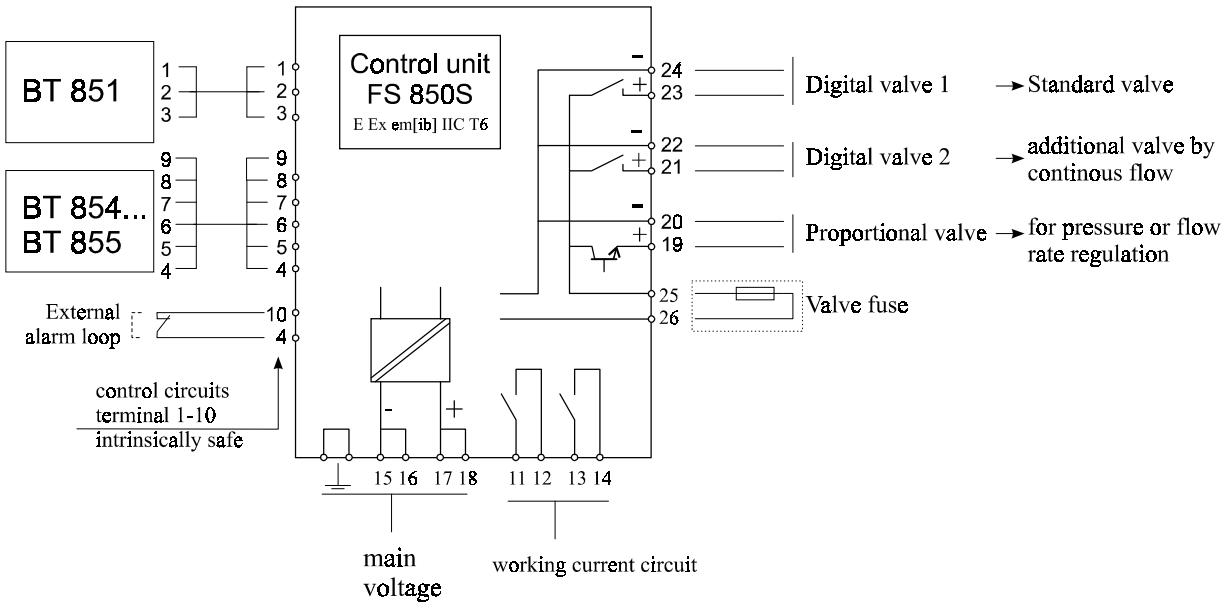


Figure 8 Electrical block diagram

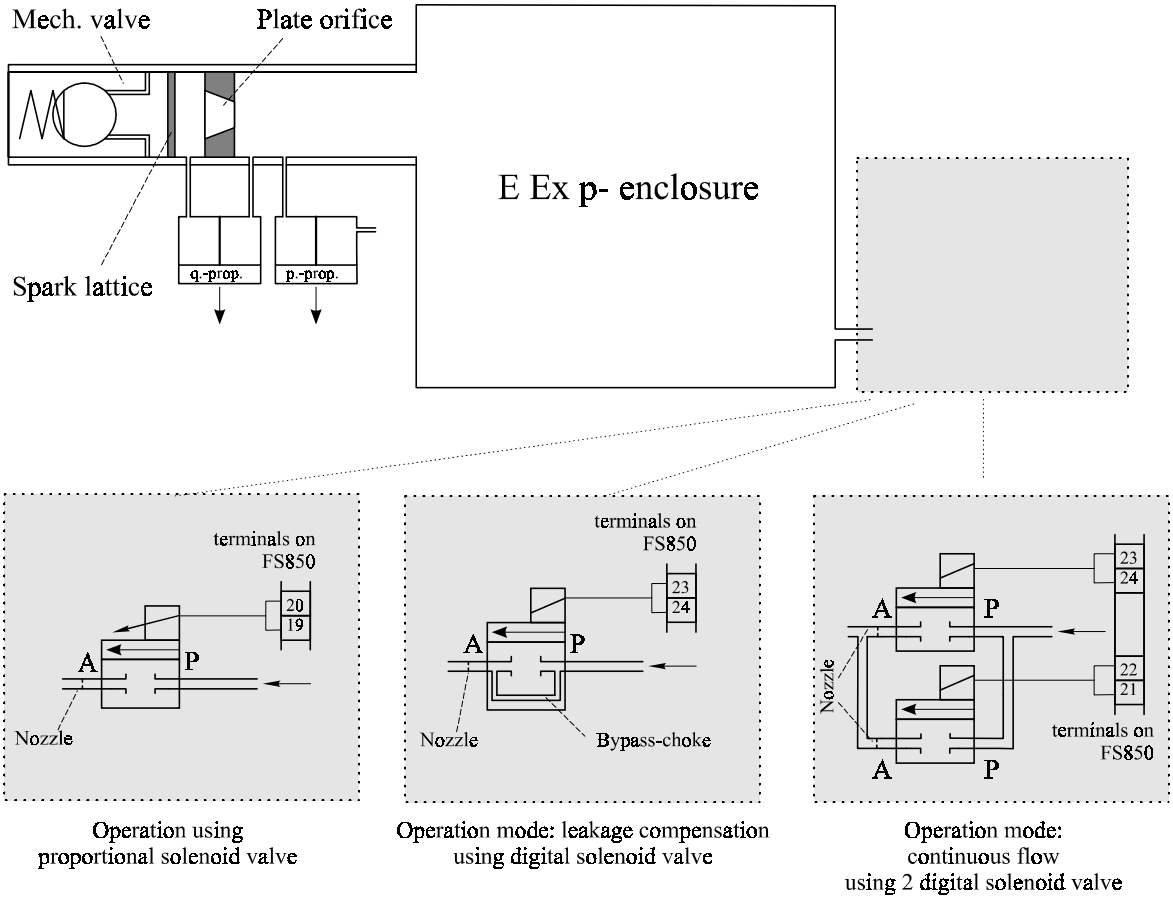


Figure 9 Pneumatic block diagram

6.4 Dimensions

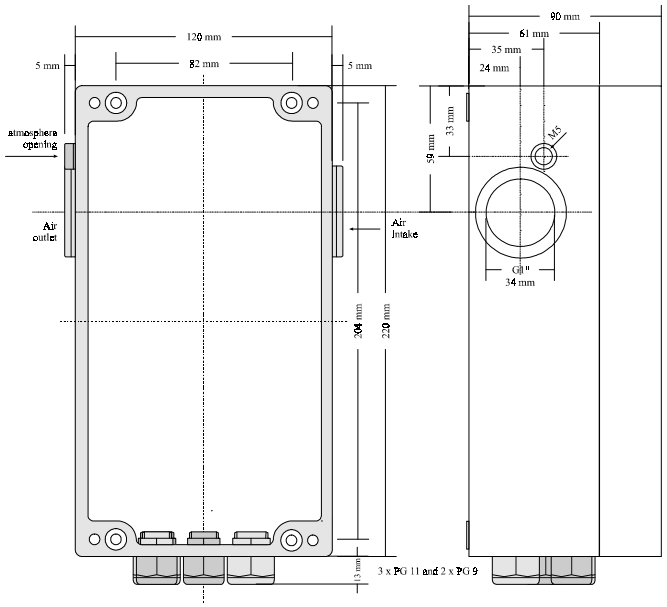


Figure 10: Dimensions FS 850S

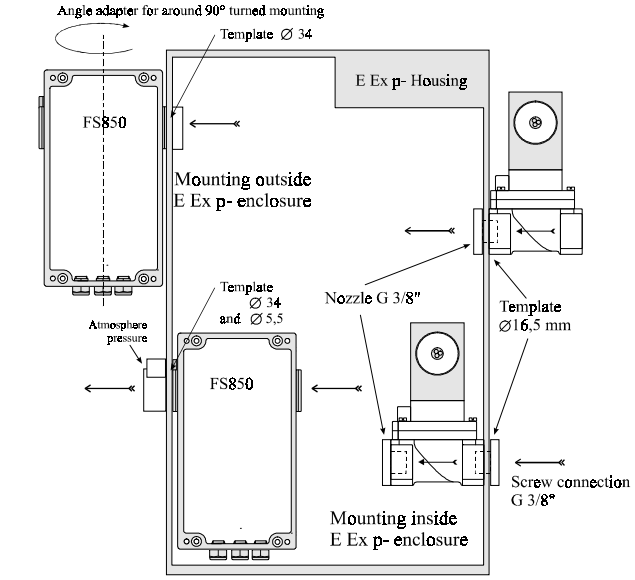


Figure 11: Mounting examples

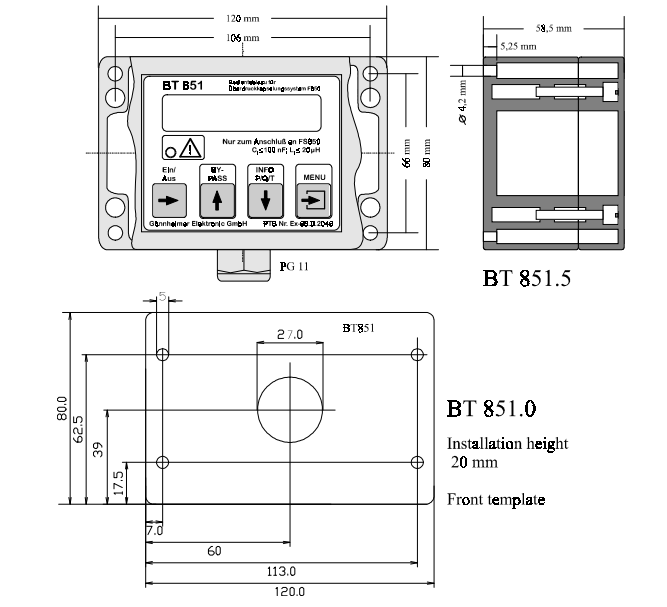


Figure 12: Dimensions and template BT 851

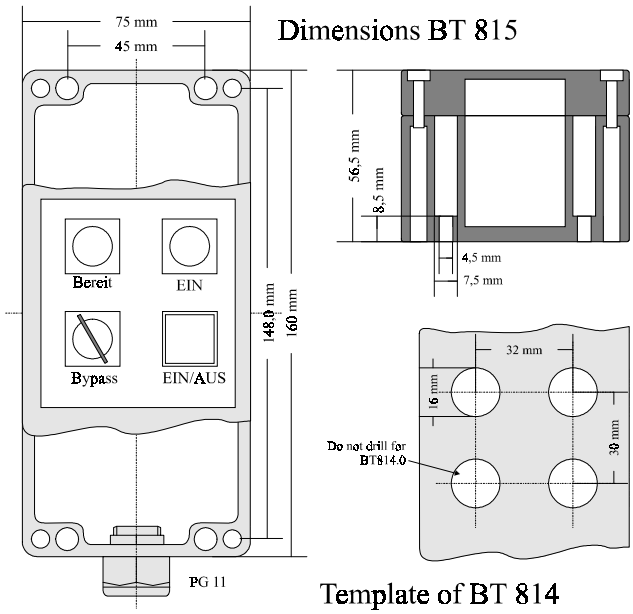


Figure 13: Dimensions BT 855, template BT 854

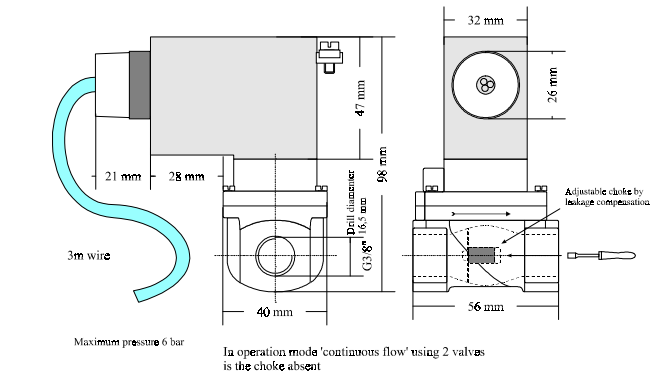


Figure 14: Dimensions digital solenoid valve

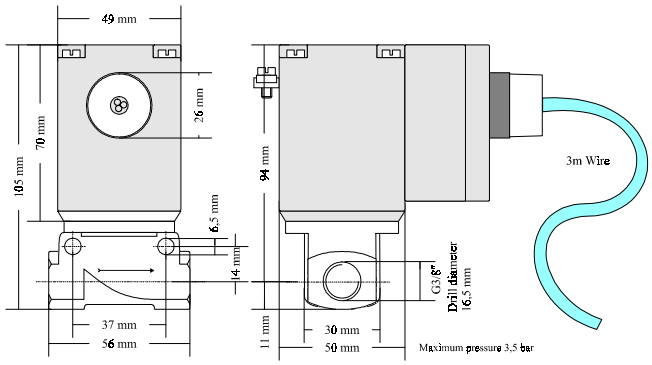


Figure 15: Dimensions proportional solenoid valve

6.5 List of Parameters

System identification	Installation no.:	Date:	
FS 850S. .	Production no.:	Solenoid valve	BT 8

Inputs	**Description**	**Display**	**Value/ state**	
Language	F850S language	Language		
Structure				
Valve	Solenoid valve type used with this purging system?	Valves Tick box	P-Valve ❑	D-Valve ❑
Purging method	Time based purging method (Integ N.) or integration purging method (Integ. Y.)	Integra. Tick box	Integ. Y. ❑	Integ. N. ❑
Operational mode	Continuous flow (C. flow Y.) or leakage compensation (C. flow N.)	Cont. Flow Tick box	C. Flow Y. ❑	C. Flow N, ❑
Parameters	Purge time	Pur. Time		
	Purge volume	Pur. Vol.		
	Minimum flow rate during purging procedure	Min. Fl. P.		
	Minimum flow rate during normal operation by op. mode continuous flow	Min.Fl. O.		
	Set-point flow rate by operation mode continuous flow	Rated Fl.		
	Pressure monitor, minimum pressure	Min. Pres.		
	Pressure monitor, maximum pressure	Max. Pres		
	Set-point pressure during purging	R. Pre. Pu.		
	Set-point pressure during normal operation	Rated Pr.		
Codes	Code for main menu	M-Code		
	Code for bypass	By-Code		
	Code to enable switching ignition-capable device	On/Off-C.		